

Formal Education

SUPPORT FOR SYSTEMIC IMPROVEMENT



NASA's Earth science education program **supports the systemic improvement** of education through initiatives and partnerships that integrate Earth system science content into the state and local education at precollege and university levels.

ELEMENTARY & SECONDARY

Alaska Alliance for Earth System Science Education

The objectives of the **Alaska Alliance** are twofold: 1) to increase public understanding of global climate variability and its relevance to Alaskan communities; and 2) to strengthen teaching and learning of related subjects in the K–16 classrooms. To accomplish its objectives the project is:

- adapting appropriate science and technology content and education materials that have already been developed and tested (e.g., NASA Earth science education resources);
- improving systemic efforts by linking existing programs with Earth and environmental education institutions; and
- augmenting existing capabilities to enable these programs to increase their scope and reach, particularly within rural Alaska.

The Alaska Alliance includes the participation of the following organizations: The Global Learning and Observations to Benefit the Environment (GLOBE) partners and schools; The Alaska Space Grant Program; Kachemak Bay National Estuarine Research Reserve (KBNERR); and Challenger Learning Center of Alaska.

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Maryland Earth and Space Systems Science Curriculum Project

NASA's Goddard Space Flight Center Education Office is collaborating with two Maryland school systems, Anne Arundel County Public Schools and Montgomery County Public Schools, to develop a new high school Earth and Space Systems Science curriculum. This curriculum will address the National Science Education Standards and Maryland's "Core Learning Goals," http://mdk12.org/mspp/high_school/what_will/science/index.html, which will provide the basis for high school performance tests. The curriculum will use a systems approach and be grounded in current Earth and space system science content.

Two courses are being developed: 1) a course for students in grades nine or ten (with Algebra One as a pre-/co-requisite) and 2) a course for students in grades eleven and twelve (with Algebra Two as a pre-/co-requisite).

The writing team is using information provided by NASA scientists as a basis for the content. The "Five E" format, from Constructivist Learning Theory, <http://www.exploratorium.edu/IFI/resources/constructivistlearning.html>, is providing the model for the curriculum design. Throughout curriculum development, Goddard's scientists have been and will continue to be consulted by the writing team to ensure accuracy of content and that the latest scientific facts, theories, and processes are incorporated into the curriculum. An advisory board will be identified to review the curriculum writing efforts.

Initial implementation of the first level of the course began in September 2000 with revisions to the first course and development of the second level course planned for the 2000/2001 school year. Goddard will provide a Web site for curriculum dissemination so that the curriculum will be made available to other school systems.

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● NASA Earth Science Education Products Workshops

The Institute for Global Environmental Strategies (IGES), through funding from NASA's Earth Science Enterprise, convenes an annual workshop for representatives from NASA Educator Resource Centers (ERCs), Aerospace Education Services Program (AESP), and Teaching from Space (TFS) Program.

Participants receive training in new NASA Earth science education products that they can distribute through their ongoing in-service teacher workshops. Participation in the annual workshop is limited to NASA ERC, AESP, and TFS representatives. These representatives then hold teacher workshops in their state, where the products are made available to teachers. Contact IGES for information on NASA educators in your state who are conducting Earth science workshops for K–12 teachers.

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● PIPELINES

www.phys.subr.edu/pipelines

The **Program to Increase the Pursuit of Education and Learning IN Engineering and Science (PIPELINES)** is a partnership between Southern University and A&M College (SUBR) in Baton Rouge and Iowa State University (ISU). PIPELINES supports activities in Earth and environmental science for students and teachers in K–12, undergraduates, graduates and university faculty. Major components of the program are:

■ *Educational reform and support for standards-based curriculum, teaching and learning*

Both SUBR and ISU offer in-service workshops designed to promote and support standards-based education, with emphasis on science and mathematics education in general and Earth and environmental science education in particular. These workshops are for pre-college teachers and college faculty. Additionally, the SUBR College of Education's Curriculum Center serves as a statewide repository for instructional materials and supplies for teachers in science and mathematics. The center holds regular workshops to aid teachers in preparing meaningful lessons and activities for students.

■ *Global Learning and Observations to Benefit the Environment (GLOBE)*

GLOBE (<http://www.globe.gov>) is a worldwide network of K–12 students who work under the guidance of GLOBE-trained teachers to make a core set of environmental observations at or near their schools and report their data via the Internet. The SUBR-GLOBE Partnership provides GLOBE certification training in the basic GLOBE protocols. Teacher participants receive GLOBE materials and supplies, as well as stipends for after-school, weekend, and holiday sessions.

■ *Undergraduate Research Support*

PIPELINES supports twenty high-achieving undergraduate students in science, mathematics, and engineering to conduct Earth science research at NASA Field Centers during the summer or at SUBR or ISU.

■ **Earth Science at the Timbuktu Academy (ESTA)** at SUBR is a six-week residential program that provides intensive academic enrichment designed to enhance the academic achievements of pre-college students (i.e., ACT/SAT). Students are exposed

to Earth and environmental science education and research, through GLOBE, and to career opportunities. Future college matriculation in Earth science related fields is a major objective of this activity. The Science Bound Program, at ISU, similarly engages pre-college students in academic enrichment activities.

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● Regional Earth Science Applications Centers (RESACs)

<http://www.esad.ssc.nasa.gov/resac/resacmain.asp>

The **RESACs** are funded by NASA to:

- 1) apply remote sensing and geospatial technologies to well-defined problems and issues of regional significance; 2) integrate these technologies into the local decision-making process; and 3) support regional assessments associated with the U.S. Global Change Research Program (USGCRP). The seven RESAC's each engage in key regional issues, including precision farm management, land cover/use mapping, urban sprawl, fire hazard management, and K–12 education.

■ *Northeast Applications of Useable Technology In Land Planning for Urban Sprawl RESAC (NAUTILUS)*

Impacts of urban/suburban growth and land use change on local communities and natural habitats.

<http://resac.uconn.edu>

■ **The Mid-Atlantic RESAC Consortium: Remote Sensing for Resource Management**

Integrated watershed and coastal management (concentrating on the Chesapeake Bay), agricultural and land management information systems, land planning applications, and environmental monitoring.
<http://www.geog.umd.edu/resac>

■ **Integrated Upper Midwest RESAC**

Minnesota, Wisconsin and Michigan

Precision agriculture, forest growth and health, and water and ecosystem resources.
<http://resac.gis.umn.edu>

■ **Northern Great Plains RESAC**

North Dakota, South Dakota, Montana, Wyoming, Idaho, and northwestern Minnesota

Providing soil water estimates to the region's farmers and ranchers and K–12 education.
<http://www.umac.org>

■ **Great Plains RESAC**

Remote-sensing products and technology to support the Great Plains Agrosystem.
<http://www.kars.ukans.edu/resac/resac.shtml>

■ **Integrated Southwest RESAC**

Arizona, New Mexico, California, Colorado, Nevada, and Utah

Application of remote sensing and regional climate modeling to water resource applications such as flood forecasting and snow mapping.
<http://resac.hwr.arizona.edu>

■ **Wildlands Fire Hazard RESAC**

Southern California

Managing fire hazards at the urban-wildlands interface.
<http://wildfire.geog.csulb.edu/resac/main/netresacmain.htm>

● **The Tropical Center for Earth and Space Studies (TCESS)**

<http://tcess.uprm.edu>

The TCESS at the University of Puerto Rico at Mayaguez (UPRM) is a NASA University Research Center (URC)—multidisciplinary research units established at minority institutions to focus on a specific area of NASA interest.

The Center's education component is GLOBE-TEST (Teachers Enhancement in Science and Technology)—a comprehensive project to align science, environmental education, and technology with current state educational reforms. The initiative will integrate sensors, calculator-based laboratory (CBL) technology, and geographic information systems (GIS) techniques, as well as the GLOBE (Global Learning and Observations to Benefit the Environment, <http://www.globe.gov>) protocols to current laboratory and curriculum in chemistry, biology, and mathematics. The overall goal of the GLOBE-TEST project is, by the year 2005, to transform a significant number of in-service and pre-service teachers into proficient educators in the areas of science and technology.

The project has designed a professional development program that combines workshops, Saturday academies, follow-up activities, and visits to schools as well as activities for teacher, faculty, parent, and student involvement. Intensive weeklong workshops and Saturday academies will provide teachers the opportunity to become skilled in the TEST activities through hands-on experiences. Follow-up activities will bring the teachers and their students to the TEST facilities at the University to integrate the science knowledge that is part of their K–12 curriculum and

the TEST experiences. In-site visits to the schools will then reinforce the teacher's project role. Overall, in five years, the GLOBE TEST project will influence more than two hundred Hispanic teachers and more than six thousand Hispanic students.

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UNDERGRADUATE

● **NOVA**

<http://education.nasa.gov/nova>

NASA Opportunities for Visionary Academics (NOVA) was created to develop and disseminate a national framework for enhancing science, mathematics, and technology literacy for teachers in the 21st century. The NOVA consortium, with the University of Alabama, Fayetteville State University, and the University of Idaho as lead institutions, is working to produce enhanced science, mathematics, and technology literacy for new teachers. This effort is accomplished through demonstrating an undergraduate science/math/technology course framework, examples of successful course models, and a mentoring support system for faculty wishing to implement new courses or modify existing courses at their universities. The framework uses interactive learning and integrates science, mathematics and technology as a means of developing a new paradigm for educating teachers. NOVA invites the participation of science, mathematics, engineering, technology, and education faculty who are concerned with

how universities prepare new teachers. Using the NASA mission, facilities, and resources, NOVA provides faculty with enhanced knowledge and skills to implement change in university courses. The NOVA team presents its framework for change primarily through three-day workshops to interdisciplinary university teams. These universities are then eligible to submit proposals for Implementation Planning Grants (up to \$30,000 for a one-year period) to initiate change in science, mathematics, or engineering courses for preparing K-12 teachers. In addition, the project links participants together through the NOVA Network, which provides the means for faculty and students to exchange and have access to the model, materials, activities, and updated information.

The schedule of workshops and application information is available at <http://education.nasa.gov/nova>. Each participating university or college must identify an interdisciplinary faculty team for the workshop. One team member must be a faculty member in the College of Education. A second team member must be a faculty member in science, mathematics, engineering, or technology. The third team member should be a university or college administrator (e.g., provost, dean, or department head). Applying teams must have access to interactive technologies and the Internet for classroom use. A memorandum of understanding signed by the deans of each college or division participating in the project must be submitted to demonstrate a university-wide commitment.

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● University Based Program in Earth System Science Education (ESSE)

<http://www.usra.edu/esse/essonline>

The **ESSE** program consists of faculty from 44 U.S. universities who are linked with one another and with NASA scientists in the development of undergraduate curricula in Earth system science. Managed by the Universities Space Research Association (USRA), the program offers financial incentives to universities that are willing to participate cooperatively with other universities and NASA in interdisciplinary curricula development for Earth system science education. Each university in the program has developed a survey course and senior-level courses in which faculty present Earth system issues as a socially-relevant, challenging, and important class of scientific problems. The objective of the survey-level course is to instill among the general student population an appreciation of the social, economic, and political implications of global change, and a scientific understanding of interrelationships between the Earth's physical and climate system and ecological systems. The objective of the advanced senior-level course is to provide students in the sciences and mathematics with an interdisciplinary perspective of Earth science and global change research. In the senior course, students from different academic departments work in teams to study and develop conceptual and computer models of physical, chemical, and biological processes of the Earth system. The senior course is taught by faculty from at least two relevant academic departments and focuses on scientific issues that draw upon the strengths of the institution. As part of the broader program, universities participate in an organized exchange of scientists and faculty,

involving visiting faculty and scientists from other participating universities and from NASA Centers.

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